

## Science Bowl Questions 1994

### Round 4

#### **Toss-Up**

1. ERSC; Short Answer: Calcite and dolomite are both carbonates. What is the difference in their chemical composition?

ANSWER: CALCITE IS CALCIUM CARBONATE –  $\text{CaCO}_3$  ; DOLOMITE IS CALCIUM MAGNESIUM CARBONATE  $\text{Ca Mg}(\text{CO}_3)_2$

#### **Bonus**

1. ERSC; Short Answer: What is the crystal structure of calcite and dolomite?

ANSWER: TRIGONAL OR RHOMBOHEDRAL

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#### **Toss-Up**

2. BIOL; Multiple Choice: Who developed the live-virus oral vaccine for polio which was approved for general use in 1961?

- a) Alexander Fleming
- b) Jonas Salk
- c) Albert Sabin
- d) Louis Pasteur

ANSWER: C – ALBERT SABIN

#### **Bonus**

2. BIOL; Multiple Choice: Which of the following structures are analogous but not homologous to each other?

- a) the wing of a bird and the wing of a butterfly
- b) the wing of a bird and the wing of a bat
- c) the flipper of a porpoise and the arm of a human
- d) the tail of a dog and the tail of a lobster

ANSWER: A – THE WING OF A BIRD AND THE WING OF A BUTTERFLY

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### **Toss-Up**

3. COMP; Multiple Choice: Which symbol would be used to redirect the output of a DOS command or a UNIX command?
- a) \* (asterisk)
  - b) ? (question mark)
  - c) < (less than sign)
  - d) > (greater than sign)

ANSWER: D - > (GREATER THAN SIGN)

### **Bonus**

3. COMP; Short Answer: Which symbol is used to connect or “pipe” two DOS or UNIX commands together?
- a) | (broken bar)
  - b) ~ (tilde)
  - c) @ (at sign)
  - d) & (ampersand)

ANSWER: A - | (BROKEN BAR)

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### **Toss-Up**

4. PHYS; Multiple Choice: A variable force is represented on an F-versus-x graph. Which of the following represents the work done by this force?
- a) the slope of the curve
  - b) the area bounded by the curve and the x axis
  - c) the area bounded by the curve and the F axis
  - d) the F value multiplied by the x value

ANSWER: B – THE AREA BOUNDED BY THE CURVE AND THE X AXIS

### **Bonus**

4. PHYS; Short Answer: A child weighing 20 kilograms is seated on a swing. The swing is positioned 0.8 meters higher than its resting point. When released what is the maximum velocity he can obtain? (Assume acceleration due to gravity to be  $10 \text{ m/s}^2$ )

ANSWER: 4 m/s

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### **Toss-Up**

5. GENR; Short Answer: Energy from sources which are constantly available in the natural world, such as wind, water or the sun, is called:

ANSWER: RENEWABLE ENERGY

### **Bonus**

5. GENR; Short Answer: What is the unit of power equal to 746 watts or 33,000 foot pounds per minute?

ANSWER: HORSEPOWER

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### **Toss-Up**

6. CHEM; Multiple Choice: Which of the following processes involves a decrease in entropy?

- a) gasoline evaporating
- b) barium sulfate precipitating
- c) breaking a window
- d) snow melting

ANSWER: B – BARIUM SULFATE PRECIPITATING

### **Bonus**

6. CHEM; Multiple Choice: Which of the following indicators would be used to indicate the equivalence point for the titration of 0.01 molar acetic acid ( $K_a=1.8 \times 10^{-5}$ ) with 1.0 M NaOH?

- a) Methyl red (Range = 3.8 to 6.1)
- b) Bromothymol blue (Range = 6.0 to 7.5)
- c) Thymol blue (Range = 7.6 to 9.2)
- d) Thymolphthalein (Range = 10.2 to 11.7)

ANSWER: C – THYMOL BLUE

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### **Toss-Up**

7. ASTR; Short Answer: What does the measurement of the spectroscopic parallax determine about a star?

ANSWER: ITS DISTANCE FROM EARTH

### **Bonus**

7. ASTR; Short Answer: Name the three stars in the Summer Triangle.

ANSWER: VEGA, DENEK AND ALTAIR

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### **Toss-Up**

8. BIOL; Multiple Choice: What type of bond forms between the carboxyl carbon of one amino acid and the amino nitrogen of another amino acid?

- a) peptide
- b) ionic
- c) hydrogen
- d) glycosidic

ANSWER: A - PEPTIDE

### **Bonus**

8. BIOL; Multiple Choice: In a 10% sugar solution, what is the osmotic potential?

- a) greater than zero
- b) zero
- c) negative
- d) greater than water

ANSWER: C - NEGATIVE

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### **Toss-Up**

9. MATH; Short Answer: If the square of the cosine of a certain angle is 0.75, what is the sine of the same angle?

ANSWER: 0.5

### **Bonus**

9. MATH; Multiple Choice: Tangent ( $A/2$ ) plus cotangent ( $A/2$ ) is equivalent to:
- a)  $2 \sin A$
  - b)  $2 \sec A$
  - c)  $2 \cos A$
  - d)  $2 \csc A$

ANSWER: D – 2 COSECANT A

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### **Toss-Up**

10. PHYS; Multiple Choice: Any body moving with simple harmonic motion is being acted on by a force that is:
- a) constant
  - b) proportional to a sine or cosine function of the displacement
  - c) proportional to the inverse square of the displacement
  - d) directly proportional to the displacement

ANSWER: D – DIRECTLY PROPORTIONAL TO THE DISPLACEMENT

### **Bonus**

10. PHYS; Multiple Choice: Which of the following is an example of a successful application of a thermoelectric process?
- a) photosynthesis
  - b) hydroelectric plant
  - c) radioisotopic batteries for space probes
  - d) photoionization

ANSWER: C – RADIOISOTOPIC BATTERIES FOR SPACE PROBES

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### **Toss-Up**

11. CHEM; Multiple Choice: Which of the following pairs would make the best buffer system?

- a) hydrochloric acid and chloride ion
- b) carbonic acid and bicarbonate ion
- c) sodium hydroxide and sodium sulfate
- d) sulfuric acid and bisulfate ion

ANSWER: B – CARBONIC ACID AND BIACARBONATE ION

### **Bonus**

11. CHEM; Short Answer: Under what relative concentrations would the buffer pair of carbonic acid and bicarbonate ion provide the most effective buffering capacity?

ANSWER: EQUIMOLAR RATIO -OR- SAME CONCENTRATIONS OF SALT AND ACID

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### **Toss-Up**

12. COMP; Multiple Choice: In the evolution of computer languages, those which first used English-like commands and advanced logic were called:

- a) assembly languages
- b) machine languages
- c) high level languages
- d) transactional languages

ANSWER: C – HIGH LEVEL LANGUAGES

### **Bonus**

12. COMP; Short Answer: Who pioneered the use of compilers in the early 1950's and was instrumental in the development of COBOL?

ANSWER: GRACE HOPPER

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### **Toss-Up**

13. BIOL; Short Answer: Identify the macromolecule which ultimately determines what proteins the cell makes.

ANSWER: DNA (DEOXYRIBONUCLEIC ACID)

### **Bonus**

13. BIOL; Short Answer: Name the main reactant in the overall equation of cellular respiration:

ANSWER: CARBOHYDRATE (ACCEPT GLUCOSE)

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### **Toss-Up**

14. ASTR; Multiple Choice: Stars twinkle primarily because:

- a) they are hot spheres of gas
- b) they continually emit radiation, but in varying amounts
- c) the Earth's atmosphere is a source of distortion.
- d) telescopes cannot be made well enough to prevent twinkling

ANSWER: C – THE EARTH'S ATMOSPHERE IS A SOURCE OF DISTORTION

### **Bonus**

14. ASTR; Multiple Choice: jAt the Vernal Equinox, an observer at the North Pole will observe the Sun at noon to be:

- a) directly overhead
- b) 23 degrees above the horizon
- c) 23 degrees from the Zenith
- d) at the horizon

ANSWER: D – AT THE HORIZON

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### **Toss-Up**

15. PHYS; Multiple Choice: Initially a body moves in one direction and has kinetic energy  $K$ . Then it moves in the opposite direction with three times its initial speed. What is the kinetic energy now?

- a)  $K$
- b)  $3K$
- c)  $-3K$
- d)  $9K$

ANSWER: D –  $9K$

### **Bonus**

15. PHYS; Multiple Choice: The use of neutrons and X-rays to determine flaws in structures is a form of non-destructive testing known as:

- a) Probes
- b) Acoustics
- c) Spectroscopy
- d) Radiography

ANSWER: D - RADIOGRAPHY

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### **Toss-Up**

16. CHEM; Short Answer: What is the term which defines a polar molecule or negative ion that is clustered about a central positive ion?

ANSWER: LIGAND

### **Bonus**

16. CHEM; Short Answer: What is the conjugate acid of the carbonate ion

ANSWER: BICARBONATE (OR MONOHYDROGEN CARBONATE) ION

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### **Toss-Up**

17. ERSC; Short Answer: What group of animals alive today is directly related to dinosaurs?

ANSWER: BIRDS

### **Bonus**

17. ERSC; Short Answer: The science of landforms is called:

ANSWER: GEOMORPHOLOGY

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### **Toss-Up**

18. GENR; Multiple Choice: Energy that results from stretching or compressing an object is called

- a) mechanical energy
- b) strain energy
- c) heat energy
- d) sound energy

ANSWER: B – STRAIN ENERGY

### **Bonus**

18. GENR; Multiple Choice: Assuming fossil fuel, for every kilowatt-hour of electricity conserved, how much carbon dioxide is saved from entering the atmosphere?

- a) less than an ounce
- b) over an ounce
- c) less than a pound
- d) more than a pound

ANSWER: D – MORE THAN A POUND

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### **Toss-Up**

19. PHYS; Short Answer: On planet Zokar, the gravitational acceleration constant is 20 feet per second squared. Assuming an object to have been dropped from a stationary hover car, how much time will elapse before the object has reached a velocity of 100 feet per second.

ANSWER: FIVE SECONDS

### **Bonus**

19. PHYS; Multiple Choice: On Earth, a typical hover car weighs about 3200 pounds. On Zokar, where the gravitational acceleration constant is 20 feet per second squared, the vertical climb velocity of a typical hover car is:

- a) equal to the mass of the car times the thrust force
- b) equal to the mass of the car times the thrust force multiplied by the time of force application
- c) proportional to the thrust force times the car mass
- d) proportional to the thrust force minus the weight of the car

ANSWER: D – PROPORTIONAL TO THE THRUST FORCE MINUS THE WEIGHT OF THE CAR

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### **Toss-Up**

20. BIOL; Multiple Choice: If a mother and daughter both have blood type A, what are the possible types of the father?

- a) only types A & O
- b) only types A, B, & AB
- c) only types A, B, & O
- d) all types

ANSWER: D – ALL TYPES

### **Bonus**

20. BIOL; Multiple Choice: In wheat, 3 different gene pairs govern the color of kernels, from white to deep red. Kernel color is an example of:

- a) sex-linked gene
- b) polygenic characters
- c) multiple alleles
- d) sex-influenced genes

ANSWER: B – POLYGENIC CHARACTERS

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**Toss-Up**

21. CHEM; Multiple Choice: Using the Arrhenius concept and the Collision Theory, which of the following statements are true?

- a) collisions that occur with an energy that is less than the activation energy do not result in product formation
- b) the higher the activation energy, the lower the number of successful collisions per unit time
- c) the larger the value of the activation energy, the slower the reaction at a given temperature
- d) all of the above

ANSWER: D – ALL OF THE ABOVE

**Bonus**

21. CHEM; Multiple Choice: For elementary reactions

- a) activation energy is always negative
- b) activation energy may be either positive or negative
- c) the reaction rate always increases as temperature increases
- d) none of the above

ANSWER: C – THE REACTION RATE ALWAYS INCREASES AS TEMPERATURE INCREASES

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**Toss-Up**

22. PHYS; Multiple Choice: People have survived falling from an airplane without a parachute because they reach a terminal velocity instead of continuing to pick up speed. In miles per hour approximately what is the terminal velocity of a human body falling near the surface of the earth?

- a) 10 mph
- b) 60 mph
- c) 120 mph
- d) 200 mph

ANSWER: C – 120 MPH

**Bonus**

22. PHYS; Short Answer: What Danish professor made the first observations of the link between magnetism and electricity?

ANSWER: (HANS CHRISTIAN) OERSTED (PRON: OR-sted)

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### **Toss-Up**

23. MATH; Short Answer: What name is used to describe a non-rectangular parallelogram with four sides of equal length?

ANSWER: RHOMBUS

### **Bonus**

23. MATH; Multiple Choice: When the trinomial ( $a^2 + ab + b^2$ ) is multiplied by the binomial  $(a - b)$  and reduced, what is the result called?

- a) binomial
- b) trinomial
- c) polynomial with 4 terms
- d) polynomial with 5 terms

ANSWER: A - BINOMIAL

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### **Toss-Up**

24. BIOL; Short Answer: What membrane separates the outer ear from the middle ear?

ANSWER: TYMPANIC MEMBRANE (ACCEPT EAR DRUM)

### **Bonus**

24. BIOL; Short Answer: Micro-organisms are frequently described in the nature of the environment in which they're found. Describe the critical growth conditions that the following term implies: psychrophilic.

ANSWER: COLD LOVING

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### **Toss-Up**

25. CHEM; Multiple Choice: The exponents in a rate law are determined by the:

- a) coefficients in the balanced chemical reaction
- b) physical states on the reactions and products
- c) actual experiment
- d) balanced chemical equation for the reaction

ANSWER: C – ACTUAL EXPERIMENT

### **Bonus**

25. CHEM; Multiple Choice: The half-life of a first-order process:

- a) is totally independent of the reaction concentration
- b) depends on the reactant concentration raised to the first power
- c) depends on the reactant concentration raised to the second power
- d) is inversely proportional to the square of the reactant concentration

ANSWER: A – IS TOTALLY INDEPENDENT OF THE REACTION CONCENTRATION

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